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AUTHOR Parker, Edwin B.
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The function of libraries is to make it easy for the people in their community to obtain information from other people or environments that may be distant is space, time or imagination. To perform this function libraries require communication media. Storage media are essential, but duplication and transmission media can improve the service of libraries. Libraries differ from other communication institutions in that they serve as agents for the receivers of information rather than for producers or distributors. Technological changes happening concurrently with social changes make libraries the logical institution to develop and manage the 'education delivery systems' that the society requires. Expansion of duplication media in libraries and library-client transmission media should be given higher priority than library-library transmission media. Cable television is likely to provide an excellent medium for library networks. Six key issues in network analysis are: Who is to be connected? Is it primarily a means of transportation, duplication or transmission? What information will be available? Will the network be shared or dedicated? What distribution of power does the network require? Should it be centralized or decentralized? (Other papers from this conference are available as LI 003360 - 003377 and LI 003379 through LI 003390) (Author/NH)

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POTENTIAL INTERRELATIONSHIPS

BETWEEN

LIBRARY and OTHER MASS MEDIA SYSTEMS*

Edwin B. Parker
Center for Advanced Study in the Behavioral Sciences**

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* Paper prepared for the ALA Library Networks Conference, September 1970.

** On leave from Stanford University, 1969-70.

Potential Interrelationships Between Library and other Mass Media Systems

Edwin B. Parker

ABSTRACT

The function of libraries is to make it easy for the people in their community to obtain information from other people or environments that may be distant in space, time or imagination. To perform this function libraries require communication media. Storage media are essential, but duplication and transmission media can improve the service of libraries. Libraries differ from other communication institutions in that they serve as agents for the receivers of information rather than for producers or distributors. Current trends in education toward more flexible and relevant curricula and toward life-long learning are in the direction of the traditional educational philosophy of libraries: help the user to learn what he wants to learn. Technological changes happening concurrently with these social changes make libraries the logical institution to develop and manage the 'education delivery systems' that the society requires. Expansion of duplication media in libraries and library-client transmission media should be given higher priority than library-library transmission media. Cable television is likely to provide an excellent medium for library networks. Six key issues in network analysis are: Who is to be connected? Is it primarily a means of transportation, duplication or transmission? What information will be available? Will the network be shared or dedicated? What distribution of power does the network require? Should it be centralized or decentralized?

Potential Interrelationships Between Library and Other Mass Media Systems

Edwin B. Parker

Functions of a Library

In examining the relationship between libraries and other communication media and institutions, it is helpful to postulate the social functions of libraries. A list of functions should aid in distinguishing functions of libraries from other media and institutions. The following list of functions assumes that a library is a social institution intended to serve at least part of the information needs of a community of people, whether in a company, a university, a school, a town, or some other kind of community. All of the detailed functions can be subsumed under the more general statement that the function of libraries is to make it easy for people to obtain information from other people or environments that may be distant in space, time, or imagination.

1. To store information in whatever media seem efficient.

The kind and quantity of information stored depends in part on the size and interests of the community being served. Libraries must not only store information to meet current needs, but must also anticipate future needs. The extent to which they should be concerned with future needs is a joint function of two factors: (1) the probability that currently available items of information will be needed later, and (2) the difference in cost between acquiring and storing it now, and acquiring it later. Historically the

storage medium has been print, although microfilm and microfiche copies of print have been commonly stored. Some libraries have performed better than others in storing information in other media: films, records, audio and video tapes and cassettes, computer cards, tapes, or disks, etc. Sometimes other institutions or agencies (audiovisual centers, film libraries, computation centers, museums, art galleries) have provided information in other media for the print library's community. In other cases information most appropriately stored in nonprint media have not been adequately stored because libraries were slow to respond to changes in information storage technology. We are postulating that it is the library's function to store needed information in all media, unless there has been a division of labor such that some other institution is meeting part of the need. This function requires effective communication with other institutions if the library is not attempting to store information in all media. It also requires that libraries have extremely good communication with their communities, in order to determine their information needs. Methods for obtaining such communication from users are discussed by Parker and Paisley (1966).

2. To facilitate retrieval of information from storage.

Storage without adequate means of access would make it impossible for libraries to meet the information needs of their communities. Traditionally, the means of access has been the local card or book catalog, supplemented by a variety of guides and indexes (usually printed and sold to more than one library).

With changes in technology of storage and increases in the size of collections, the complexity of retrieval problems has increased. Changes in the technology of access and retrieval (principally computer systems) are creating new challenges and new opportunities, but the function of providing retrieval from storage to meet the requests of the library's community remains unchanged. Retrieval service may be requested on a one-time basis and on a standing request basis (e.g., selective dissemination of information services). Retrieval services may be requested for reference retrieval only (to get the right book for the client) and for specific content information (e.g., library reference services). Libraries failing to provide a sufficiently broad range of retrieval services to meet the needs of their communities are failing just as much as libraries that do not store information needed by their communities. An appropriate acronym for systems that emphasize storage without adequate retrieval would be SNARL (Storage Now and Retrieval Later).

3. <u>To teach people to use the media of storage and retrieval and to inform them about the library's services.</u>

Examples of traditional library services intended to enhance the efficiency or enjoyment to use the library's services are: children's story hours designed to teach children the enjoyment of books, instruction in how to use the catalog and other bibliographic tools, and newsletters announcing planned events or new acquisitions. This function requires libraries to assume the role of communicator, sending informative and instructional messages to

their communities. A variety of media may be used for such communication, including interpersonal communication with individuals or groups, cheaply duplicated instructions, expensive newsletters, book review or story hour programs on radio or television, physical displays of books, documentary or instructional films, and computer-aided instruction. Programs of instruction to improve reading skills or to provide literacy training for functional illiterates have sometimes been included as a function of libraries. Such tasks are appropriate for libraries whenever other institutions, such as the schools, have not adequately performed them. As new media for storage and retrieval come into increasingly common use, instruction in the use of such media may become more needed, particularly if schools do not teach it (as they do for print).

4. To facilitate learning.

This function is redundant with the previous three in that storage, retrieval, and provision of information and instruction about how to retrieve information do facilitate learning. The point in listing it separately is to empahsize the role of the library as an educational institution. The establishment and maintenance of public libraries were justified on the basis of the adult education functions they performed. The university library was formerly thought of as the heart of the university, although that view has been in decline recently, particularly in the sciences. The library provides education not as a teaching institution with scheduled courses and curricula (except possibly for the limited function discussed in function three above). Rather it

serves as a continuing education center or people's university in which people are assisted in learning what they want to learn when they want to learn it. The storage and retrieval functions can provide much of the assistance to individualized learning, but careful analysis of what is needed to facilitate individualized learning by the library's community may indicate additional services not available elsewhere that the library may be best equipped to provide. Availability of programmed instruction materials, teaching machines, facility for playing and recording audio materials (to facilitate language learning, for example), and computer-aided instruction programs are examples of services that might be included. Current educational philosophy is turning toward concepts that emphasize individualized learning and a student choice of subject matter and time of learning. The concept of a library as a place of learning is an ancient one into which new life can be breathed by recent and impending changes in the technology of individualized learning.

5. <u>To provide an information switching and referral center.</u>

No institution can provide all things for all people. Nevertheless, there is a need for an information center or service where people can go to find out where they can turn to find information they are seeking. Many library reference services and specialized information centers provide such services, at least in the subject matter of their special expertise. As society becomes more complex and more specialized information services become available, and as interconnection becomes more feasible technically,

there is likely to be increasing demand for referral and switching services so that individuals can use their local library as a one-stop information service, with confidence of being referred to the appropriate place when the desired information is not available locally.

Differences in Use of Media by Libraries and Other Institutions

It is helpful to emphasize the obvious distinction between communication media (books, magazines, films, television, telephones) on the one hand and, on the other hand, institutions that produce media content, manage media channels, store media content, or utilize media. Schools, libraries, bookstores, publishing houses, and broadcasting companies are examples of institutions involved in the production, management, storage, or use of media.

In contrasting and interrelating the functions of different communication institutions, it is helpful to contrast different kinds of media. Communication media in general perform the function of making possible communication between people who are distant in space or time such that face to face interpersonal communication is not possible. Communication through time requires a storage medium (stone tablets, papyrus, books, films, magnetic tape, etc.). A storage medium may be used for communicating with oneself through time (shopping lists, private diaries, etc.), for private person to person communication (letters sent through the mails), or for communication to larger selected or public audiences. If

the contents of a storage medium are to be available in more than one place at the same time, then there must be a duplication medium (printing press, Xerox machine, microfiche printer, etc.) to provide multiple copies. It is useful to further subdivide duplication media into single copy duplication or multiple copy duplication. Xeroxing a copy of an article for a library client is obviously single copy duplication while printing a newsletter for distribution to many clients is multiple copy duplication. A single copy of a book held by a library, although once duplicated, is not a duplication medium because it cannot be available at more than one place at the same time without further duplication.

If a storage medium (duplicated or unduplicated) is used to communicate through space as well as time, then the medium itself must be transported (usually by means used for people or other goods: trucks, planes, trains, bicycles, etc.) or transformed into a form suitable for a transmission medium (as in the transmission of a film via television or a tape-recorded message by telephone).

Some communication media are transmission media only, requiring some other medium for storage. Transmission media can usefully be subdivided into point-to-point (as in the telephone) and broadcast transmission (as in radio and television). Transmission media are of little use for libraries or library networks unless they are combined with a duplication medium. The combination of a transmission and duplication medium may be point-point (as in telegraph or teletype systems or point-to-point facsimile) or broadcast (as in broadcast facsimile or broadcasts recorded on audio or video tape at the reception end of the transmission).

To date, libraries have been concerned with transportable and nontransportable (noncirculating) storage media, occasionally with single copy duplication, and rarely with point-to-point transmission and duplication. Multiple copy duplication is usually thought of as a publishing function rather than a library function. Broadcast transmission (whether duplicated or unduplicated) is quite remote from library functions because broadcast transmission does not permit users to retrieve information on demand.

Unlike schools operating under compulsory attendance laws, libraries typically do not have a captive audience and do not have prescribed curricula that some agency has decided their clients must learn. The library is a client-centered instituion serving a community of receivers of information. (See Paisley and Parker [1965] for a discussion of information retrieval as a receiver-controlled communication system.) Other institutions (schools, advertising agencies, publishers, broadcasters, etc.) serve the senders in the process of social communication. The library has the unique function of being the general agent for the receiver in the communication process.

As a consequence of this emphasis, libraries are primarily concerned with media for storage of information rather than media for transmission of information. Libraries may use transmission media such as telephones or radio or television, but it would be out of keeping with the function of libraries to operate communication media that do not have storage properties or provide connections to storage. Storage is an essential ingredient if the

information is to be made available to the receiver at a time of his choosing rather than a time of the sender's choosing.

Similarly, libraries are not concerned with the original production of communication media or communication messages, with the exception of tools for access to previously existing messages. Libraries may be centers where scholars engage in original creative work, but the primary function of libraries is to provide the information needed by such users. The intellectual task of providing tools for access to information is a significant and challenging one--one that becomes increasingly important as the volume of primary information increases--but it is a special case of research needed to improve the library's functioning.

Libraries differ from bookstores in a significant and ironic way. The key difference is the basis of economic support. The bookstore (or that now almost extinct species, the profit-seeking lending library) is concerned with serving those information needs for which the clients can pay sufficient money that it is profitable to provide them. The source of income for a bookstore provides a close communication link with its clients. Either it continues to meet the information needs of the clients or it goes out of business. Clients influence what is available by their economic transactions. The bookstore management usually has the option of choosing to serve one group of clients instead of others or meet one particular kind of information need rather than others, depending on what services and clients are likely to prove profitable. The library typically receives its financial support not from the individual clients but from an institutional surrogate for the clients,

such as a governmental unit representing taxpayers or a university or school management. This lack of a direct economic link with the clients makes it more difficult to serve as an agent for the receivers of communication. The feedback information from the clients is much slower and less reliable when it is filtered through some other bureaucracy before reaching the library. The library is not motivated by profit-making, but it must remain economically viable. In the short run, this can be accomplished by pleasing the funding agency, but because the funding agency is likely in the long run to be responsive to its source of support, usually the tax-payers, then the library is more likely to survive if it has adequate feedback from its clients, and can demonstrate to the funding agency that it is meeting their information needs. The community it serves is usually defined for the library by the outside funding agency, rather than open to free choice (like the bookstore), although libraries often end up serving only a fraction of the potential audience because there are inadequate mechanisms for the others to communicate their needs. Libraries are thus in need of special communication links to their communities to compensate for the fact that they have a responsibility to serve a particular audience not chosen by them and the fact that usual economic feedback links are absent. 'Free' library service has the advantage of redistributing funds so that poor and rich alike can obtain access to needed information, but the lack of economic feedback mechanisms may make it less reponsive to the needs of its community than it might otherwise be.

Functional and Physical Networks for Libraries

We can think of a communication network as a transmission medium with switching capability to interconnect different nodes (points in the network) at different times. The interconnection between nodes may sometimes provide for only one-way communication, but more typically two-way communication is required so that the roles of sender and receiver can be reversed.. Some networks permit broadcast communication in which the same messages are received at multiple nodes, but frequently only a single receiver is associated with a single message (as in the telephone network). Some networks do not provide duplication or storage capability, while others (e.g., facsimile transmission) require that the message be duplicated at the receiving end in some medium other than the transmission medium. Before discussing the physical means of providing library networks it is helpful to discuss the functions that the network is intended to serve. We should first ask what are the nodes that should be connected together, what kinds of messages are to be transmitted, who controls the choice of messages, and what duplication of messages into a storage medium at the receiving end is required.

There are three basic types of library networks to consider. One is the network connecting a library to each of its clients. Unlike the telephone network that permits any client to be connected to any other client, this kind of library network provides the option of connecting any client to the information centrally stored by the library. The second network is that connecting

different libraries to each other. There are a large number of network configurations possible. Each library can be connected to each other in the network, each branch library can be connected to a main library but not to each other, a hierarchy can be established in which each branch library is connected to a regional library which is in turn connected to a central library (e.g., the Library of Congress). Mixed modes can be established in which main libraries are all interconnected, but branch libraries are connected only to their main library. The third network is a combination of the first two: the network for connecting the clients of one library to a different library. There are two basic forms of this network. One is for the original library to serve its client by using a library to library network to obtain for him what he needs. The other is for the original library to switch the client directly to the appropriate other library so that the client can be served directly by the other library.

All three types of networks exist already, using technology that has been available for many years. Interlibrary loan agreements that depend on mail or messenger service constitute one way to implement the second and third type with current technology. By taking out a library card and coming to the library to borrow a book, a client becomes part of the library-client network. It is thus helpful to distinguish between two kinds of network questions: (1) the administrative agreements by which different libraries enter network arrangements or by which clients are entitled to obtain library service, and (2) the technical means by which the network agreements are implemented.

There are a variety of technical means by which networks can be implemented. Detailed comparisions of the technical choices are provided in other papers prepared for this conference. For our purposes we can distinguish three types: traditional, dedicated electronic, and shared electronic. Traditional means include interpersonal communication and transportation, use of messengers, mail, etc. Dedicated communication lines can be used for computer interconnection, facsimile transmission, etc. Cheaper than dedicated lines, unless the transmission volume is very great, are shared communication networks, such as telephone or teletype networks. Another possibility is to share communication networks developed for computer or cable television interconnection. A key property of electronic networks for library systems, whether dedicated or shared, is that the message must be duplicated so that it still exists at the sending end after it has been received. Traditional networks may or may not have this property--original copies of books are sometimes transported without duplication.

Social Trends Affecting Media and Library Networks

Continuation of several present social trends is likely to create additional demand for library services and library networks. Increases in the average level of education and of reading skill will continue. Library circulation has continued on an upward path even during the introduction of paper-back books and television. Even though competition from other media resulted in lower utilization than would otherwise have been the case, demand for library services has been

steadily increasing. See, for example, the Parker (1963) study of the effects of television on library circulation. As our society becomes more complex, both organizationally and technically, an increasingly higher proportion of human energy must be spent on information processing. Two propositions from system theory are particularly relevant: "As the complexity of a system increases, a disproportionate increase in information processing components is required." "Up to a maximum higher than usually attained, the greater the percentage of energy consumed in information processing relative to other functions, the more likely the system is to survive." (Quoted from James G. Miller's Living Systems,1965.)

Increased geographic mobility and increased interest in the boundaries between subject fields both contribute to the growing demand for diversity in information and the difficulty of any one library in providing all of the information required. The increase in scientific interest in interdisciplinary areas provide one example of demand for interconnectability--it is becoming harder to compartmentalize information requirements on either a geographic or subject matter basis because people who are primarily working in one geographic or subject area are often interested in information from other areas and are on the boundaries of whatever division of information was established. The range of variation in information requested is likely to increase faster than any 'average' information demand. As people become more geographically and psychically mobile, the range of information needs will increase. The implication for libraries is that there will be increased need to back up local

library holdings with information resources in other libraries if the information needs of library clients are to be met.

Social trends in education are likely to increase the importance of and requirements for libraries and library networks. According to Dr. Thomas F. Green (1970), Director of the Educational Policy Research Center at Syracuse University in recent Congressional testimony, "The growth of education outside the formal system has probably been the most significant change in education over the years just past...In the current year, more people will be receiving instruction of a formal sort outside the formal education system than within it." Demands for informal education are also increasing. For some years now we have been paying lip service to the concept of lifelong learning. The need for continuing education to compensate for the fact that what is learned in school no longer provides sufficient information or skill to last a lifetime. In most occupations, it is not possible to take a sabbatical in order to go back to school. In many occupations it is not possible or convenient to engage in regularly scheduled continuing education of the night school or summer school variety. The library provides the major means for self-study programs. As the technology of individualized instruction changes to permit individual learning from computer-aided instruction and audiovisual media, libraries are challenged with the option of continuing to perform that traditional function of catering to individualized learning, or giving it up to other institutions by default. Student demands for more 'relevant' education and for more flexible curricula with a wider range of choice are moving education (at least higher education) in the

direction of providing the education that the student chooses. The movement for 'relevant' education is essentially a movement toward a student controlled curriculum in which the learner is instructed in what he wants to learn. Psychological studies have long demonstrated that learning is more effective when the learner is motivated to learn. These trends toward individualized instruction in subjects chosen by the learner are trends toward exactly the kind of educational service libraries have long been providing. Both the need and the opportunity are evident: it is possible to build 'living libraries' or 'education delivery systems' that are responsive to the educational needs of their clients by providing individualized instruction in a variety of media, including computer-aided instruction. In order to provide such a service, it will be necessary to have a communication network connecting the library to its clients.

If the library is to maintain its present functions as the society places new demands and the technology provides new opportunities, this is the direction libraries must develop. Since individualized instruction in nonprint media is likely to be expensive to provide, and since people are willing to pay for such service, it may be necessary to charge for some library services instead of providing all services free. In order to maintain the beneficial distribution of wealth function that is one of the advantages of a free library system, it may be desirable to provide public education subsidies to the consumer in the form of 'information stamps' that can be spent at the library or other educational institutions.

That way favorable distribution effects can be maintained while gaining the advantages of letting people with the financial resources pay for additional service, and providing an economic feedback to ensure that the library is responsive to the information needs of its clients.

Technological Trends in Media Affecting Library Networks

Three technological trends in communication media will be taking place during the first half of the 1970's. All three should be followed carefully because of their implications for libraries and library networks. One is the video cassette for home display of audiovisual materials. The second is development of computer systems for library automation, information retrieval, and computer-aided instruction. The third is rapid expansion of cable television.

Within the next two years both CBS and RCA are planning to have on the market video cassette systems that will permit people to watch movies, plays, instructional lectures and demonstrations, or other audiovisual material over their home television set at times of their own choosing, just as people now play records on their home record players. The video cassette player attaches to the antenna leads of the television set. The recorded information and entertainment is in cassette form, making the system as easy or easier to operate than a record player. One merely has to drop the cassette into the appropriate slot and push a start button. By providing an economical and simple to use audio-video storage and duplication medium, much information now available only

for transmission media can be available in stored form, just as books are stored.

This development in media has two implications for library networks. One is that there will be a great public demand to be able to borrow cassettes, just as now there is a great demand for borrowing books from libraries. Library acquisition policies and interlibrary loan policies will have to be developed to respond to the opportunity and the demand. Public libraries may have an excellent opportunity to broaden their base of public support by providing on loan video cassettes for all segments of the population, including those who seldom borrow books from the library. It is quite possible that communities will be willing to increase the amount of taxes allocated for library services if services can be expanded to include video cassette loan services. Cassettes are not as easily damaged as phonograph records, so that libraries may be more willing to circulate cassettes than records. Cassettes, like books, are a transportable storage medium. A cassette lending service would constitute almost the least possible change in type of library service.

The second implication of video cassette systems for library networks is that it is likely to increase public demand for library to client networks. Assuming that libraries do respond to the need and provide loan copies of the kind of information and entertainment now provided by transmission media (i.e., television), people are more likely to articulate the already present latent demand for communication networks to deliver both print and audiovisual

information to their homes on demand. This is speculation, of course, but it seems reasonable that the fact of receiving video information from libraries on demand when they formerly received it (and concurrently receive it) by a transmission medium (television) will increase the articulated demand for on-demand transmission of information. On-demand video service is unlikely to be economically possible in the next ten years, unless AT&T increases the resolution quality of its picturephone service. What may be economically possible in ten years is point-to-point transmission and duplication network connecting libraries and clients for transmission of print information (possibly using telephone or cable television channels).

There are two main classes of use of computers for library automation: online, in which librarians or library clerks interact conversationally with the computer system from a visual display or typewriter type computer terminal; and batch processing, in which jobs are submitted to the computer to be run at a later time, with the results obtained some hours later, or the next day. When we think of library networks, we tend to think of online systems, but batch systems for library automation also have implications for library networks. Implementation of computer systems permits standardisation and centralization of services that can bring about significant economies in operation. Use of MARC tapes from the Library of Congress, for example, connects libraries in a network with the Library of Congress, as does use of LC cards, even when the tapes or cards are distributed by mail.

Online library automation projects lead more naturally to transmission networks (as distinguished from transportation networks

for delivery of cards, tapes, or books). Online systems within a single library provide a simple kind of network within the library, connecting to a central file all librarians and clerks who have access to terminals. Such a network, with a central 'in-process file' for acquisition and cataloging functions can be particularly useful in decentralized branch library systems that have centralized ordering and processing. Branch librarians can perform their functions better if they have access to current status information on all orders by their own and other branches, just as computer airline reservation networks make the work of airline reservation clerks much simpler. Since the costs of online systems are still very great, it is possible that a system developed for one library system will be used by others, or that such systems will be developed by outside organizations with the intention of selling services to several libraries. At present, the cost of online storage for large catalogs is still high, but costs are coming down and demand is likely to go up. Some such systems already exist. The SUNY Biomedical Communication Network in New York has provided a union catalog of bibliographic information from several medical libraries which can be searched by computer terminals in each of the libraries. (Pizer, 1969). The Bell Telephone Laboratories' Library has activated an online circulation system (Kennedy 1968). That system includes the catalogs of three libraries several miles distant from each other.

Online systems for library automation link libraries and librarians together into networks. Once such systems are developed

it is logical to permit library users to have access (particularly to catalog or circulation files). At this point the distinction between online library automation and online information retrieval systems becomes blurred. The online library automation system is an information retrieval system. Whatever other functions it also serves internally for libraries, the online information retrieval system available to library clients is a network linking clients to libraries. Two examples of such systems are the INTREX system at MIT (Overhage and Harmon, 1965; Project INTREX Staff, 1966-1970) and the SPIRES/BALLOTS system at Stanford. The Stanford Public Information REtrieval System (SPIRES) has been used for online searches of physics preprint files at the Stanford Linear Accelerator Center since the spring of 1969, and is being developed in conjunction with the Stanford Library's Project BALLOTS (Bibliographic Automation of Large Library Operations using a Time-Sharing System), which will provide online technical processing service for the Stanford Libraries. (SPIRES Annual Report, 1970.).

Library-client networks using computer systems are developing first in universities and research laboratories, not surprisingly, indicating the beginning of a general trend for the future. Once libraries are connected to their clients by computer networks, then many other possible services should be considered. The most significant service, in addition to information retrieval, is computer-aided instruction. There are two reasons why libraries should be following closely developments in computer-aided instruction as well as computer information retrieval. One is simply that if they are providing programmed instruction textbooks on loan

(a typical library service), then why shouldn't they offer the same kind of programmed instruction when it is available by computer instead of between printed pages? The other reason is that information retrieval and computer-aided instruction systems are developing on converging paths. As information retrieval systems develop, more complex facilities will be added, including retrieval of text material as well as references to text, and fact retrieval or other processing of textual information. At the same time, as computer-aided instruction systems progress beyond drill and practice programs they will begin to look more like complex information retrieval systems. At some point it may be both hard and irrelevant to distinguish whether a set of computer programs and associated data base for a college level history course is an information retireval system or a computer-aided instruction system. In any event, the present implication is clear: those concerned with future development of library to client networks should follow developments in computer-aided instruction as well as computer information retrieval.

The third technological trend that should be followed carefully is the growth of cable television. The cable television industry is predicting that nearly 50% of U. S. homes will be connected to cable television systems by 1975 and that 85% will be connected by 1980 (See, for example, Dunlop, 1969). The technology of cable television is developing more rapidly than many observers had earlier expected. Some systems are being introduced with 42-channel capacity and return communication capability. A June 1970 FCC proposed rule-making specified the FCC's intention

to impose a rule requiring the availability of two-way communication capability. The June 24 Notice of Proposed Rule Making released by the FCC July 1, 1970 says: "We intend that future cable systems should be installed in such a manner that...each subscriber may be afforded a means for directly communicating with a local program origination point. This return communication capability should provide at least the capacity equivalent to a single 4 kHz message channel and may be shared with a limited number of other subscribers so that cuing problems are avoided."

The implication of cable television developments is that two-way cable television channels will provide libraries with the opportunity for broadband communication network access to the homes of many of their clients. All over the country local governments are issuing cable television franchises, many of them for periods as long as 20 years or more. Librarians in any community in which cable television franchise decisions are pending should look into the terms of the franchise agreements that are proposed. Many franchise agreements include requirements for civic channels to be available to the franchising municipality. Libraries should consider urging the reservation of channels that could be used for transmission of library services, and should encourage requirements for early implementation of two-way channels.

Key Issues in Network Decisions

Viewed from the perspective of interrelationships with mass media and communication institutions there are six key issues

to consider in library network decisions. The issues cannot adequately be examined separately since they are closely interrelated. The six issues are: (1) Who is to be connected by the network? (2) What general type of network is intended? (3) What information will be available in the network? (4) Will the network be dedicated or shared? (5) What distribution of power does the network require? (6) Should the network be centralized or decentralized?

Who is to be connected by what type of network?

Both library-client and library-library networks will be needed. The meaningful question is what priority should be placed on these alternatives. In order to answer that question it is necessary to consider what changes in the type of network for each of the two major alternatives will be the most useful in carrying out the functions of libraries. Present library networks, whether library-client or library-library networks, depend primarily on physical transporation of the storage medium (i.e., the book is borrowed). There are essentially two ways to improve these networks. One is to interpose a duplication medium, so that multiple users may be served from the original copy. (This kind of single copy or on demand duplication should be distinguished from the multiple copy duplication that we now know as publishing.) The other is to improve the transmission link.

Until there are improved transmission links in the library-client network, it is premature to concentrate on technical improvement of the library-library transmission link. Instead, the priorities should be to work on improved duplication for both

networks and improved transmission for the library-client network. Primarily because of copyright problems, there are serious administrative difficulties as well as technical difficulties to be resolved in creating duplication networks. The potential gain both for the library and the client is so great that it is worth investing major effort in solving this problem. Transmission without duplication cannot help libraries to perform their functions, because storage is an essential part of the mission of libraries. Whether duplication is made by Xerox copies, photo-duplication, distribution of disposable microfiche from which hard copies can be made, facsimile, or some other means, the library would always have a copy of all of its information available for all users without users queuing for the same material or being inconvenienced by theft or loss of the original. The borrower would be able to keep the copy he receives without needing to return it for other borrowers.

The reason for putting library-library transmission networks at the lowest priority level is simple: duplication rather than transmission is the bottleneck in interlibrary transactions. Libraries may be reluctant to enter into inter-library loan agreements if their information is out of circulation for their own clients when on loan elsewhere. Electronic transmission plus duplication is likely to be much more expensive than duplication plus transmission through present channels (such as the U.S. mail) for some time to come, particularly if microfiche rather than hard copy is used. See, for example, the February 1968 University of California Institute of Library Research

report, "Telefacsimile in Libraries" by William Schieber and Ralph Shoffner. The advantage of electronic transmission is the greatly increased speed of transmission (although queuing problems may prevent some of that advantage from being realized). That advantage may be almost completely nullified if there is no electronic link to the client and he must depend on traditional transmission channels. Until the transmission links extend from the library to the clients, the expense of library-library transmission links will be largely wasted if the link to the client depends on traditional transportation. Therefore the priorities should be clear: Give highest priority to solution of problems associated with duplication, second priority to library-client transmission networks, and lowest priority to library-library transmission networks.

What information will be available?

Present library networks that include transmission capability provide only status or surrogate information such as catalog (or augmented catalog) information or circulation status information. Actual content (with the minor exceptions of the Project INTREX text-access experiment and occasional facsimile experiments) is transferred by the traditional transportation mechanisms of interlibrary or library loan systems. Network characteristics and cost considerations will be quite different depending on which of four general classes of information are available. Reference retrieval, text access, data or fact retrieval, and processing capability (including computer-aided instruction) constitute the four general classes. Retrieval of the text of a book or article

is not the end process in information access. There will be a continuing demand for access to particular facts, data, or information contained in storage media, whether in books or in machine-readable data archives. Social scientists examing census data, for example, are no longer satisfied with data reported in published census volumes. Instead, they often want to study particular data tables or cross-tabulations that may not be contained in the printed census reports. With access to basic data, or to the one in ten thousand sample of census data, the desired table can be constructed. In other words, he needs both data retrieval and processing capability to find the information he is seeking. Computer-aided instruction is another example of the combination of retrieval and processing capability. Demand will be strong for all four classes of information. Which can be provided soonest will be more a function of technical possibility and economic factors than of demand factors. All four classes should be considered in the course of network planning.

Will the network be dedicated or shared?

Telephone and telex networks are often the most economical for many purposes, especially when the traffic volume is light, because costs are shared with a large number of other users. Even when volume is sufficiently large to justify a dedicated line, it is often economical to lease it from AT&T. Even though use is dedicated to single user during the term of the lease, the term of the lease may be for less than the life of the equipment, which is shared with other users at different times (measured in months or years). Sharing of conduit space or maintenance costs

may also be economical. The comparisons to be made are the technical and economic ones to which other papers in this conference are devoted.

A key question of sharing arises in library-client networks, particularly in considering networks connecting public libraries to homes. It is unlikely that a dedicated network could ever be justified for library-client communication, but both telephone and cable television links into the home provide an opportunity for libraries to share networks. Depending on how costs are billed, communication charges could be low in both networks. When local telephone calls are billed at a flat monthly rate instead of unit time charges, client communication charges may be 'free', although there would be additional equipment costs at each node in the network. With cable television operators looking for additional services that they can offer their subscribers as inducements to pay a flat monthly rate for the cable connection, that broadband channel may also be free except for terminal equipment costs. Thus network planning should not overlook the possibility of obtaining transmission links at a small or zero marginal cost by sharing with another network instead of developing dedicated links. The economies of shared networks are likely to be considerable.

What power distribution is required?

When a single library develops an internal network among its branches or within the single library, or between the library and its clients, then little change in the distribution of power is required or to be expected. On the other hand, when

library-library networks are developed some redistribution of power may be required or may be expected to follow. Suppose that two or more libraries when joined together in a network can produce a cost savings through joint operation or division of labor without reducing service, or that improved service can be provided without increase in cost. It would seem logical to implement the network connecting such libraries. However, in order to accomplish the savings or improved service, it is necessary for each library to give up some of its autonomy. Joint standards have to be adopted and each library no longer has full authority over all of the operations for which it has responsibility. As an experienced administrator can point out, separation of authority and responsibility can lead to serious administrative difficulties. A director of libraries who has the responsibility to provide service to his community, but who has lost his authority to provide that service can find himself in serious difficulty. It is for this reason that library directors involved in library automation would prefer to have the computer staff under their direction rather than reporting to someone else (such as a computation center director). The computation center director (or the administrative officer of any other node in a network to whom authority has been transferred) may not understand the local library's problems as well as its own director does. Consequently, what is optimal for the entire network or system may not be optimal for a given local library. If the network involves other media and institutions besides the library (computation centers, cable television systems, etc.) the danger

of administrative difficulty is more severe than if only libraries are involved. If the directors of all the institutions involved in the network report to a common higher authority (as branch librarians report to the director of the library system), then questions of authority and responsibility can be resolved. When there is no such administrative mechanism, it may be dangerous for a library to give up some of its authority in the interests of larger efficiency, because its own local operations may suffer. Explicit analysis of potential effects on power relations should consequently be part of any network analysis.

Should networks be centralized or decentralized?

In addition to the administrative organization questions raised in the preceding paragraph, the basic question of technical reliability must be asked. The question can be posed as one of soundness of the ecology. The typical arrangements in electrical power networks are such that each node in the network is completely dependent on the network for power, with the exception of particularly critical nodes such as hospitals which may have emergency power generators. This can lead to serious difficulty and inconvenience as serious power blackouts on the Eastern Seaboard of the United States and elsewhere demonstrate. The vulnerability to technical failure or to deliberate sabotage is much greater in a centralized network. Although it would be more expensive, a decentralized system with local power generation and dependence on the network for auxiliary service would be based on sounder ecological principles. This decentralized network principle is typically practiced by library clients. They will buy books most frequently needed, whether or not the library has them, in order to be as independent of the

library as possible. In the case of library networks, it may be more economical than in power networks to provide a given level of decentralization, using the network facilities as backup rather than as primary sources of essential service. Given the speed of the past and projected future change in computer technology, computer systems are unlikely to be as stable as power systems for some time to come. Therefore, reliability considerations should be carefully weighed in making network decisions. It is likely that reliability considerations would push an otherwise close decision in the direction of decentralization.

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